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Certified by

Jon W Dudas

Acting Under Secretary of Commerce
for Intellectual Property
and Acting Director of the U.S.
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PROVISIONAL PATENT APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION for patent under 37 C.F.R. §1.53(c).

Docket Number	8200.846	Type a plus sign (+) inside this box	+

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TITLE OF THE INVENTION (280 characters max)

PRESSURE VESSEL FOR INTEGRATED PRESSURIZED FLUID SYSTEM

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ENCLOSED APPLICATION PARTS *(check all that apply)*

- ☒ Specification - *Number of Pages* 4
- ☒ Drawing(s) - *Number of Sheets* 3
- ☐ Small Entity Statement
- ☐ Other (specify) _____

METHOD OF PAYMENT *(check one)*

☒ A check or money order is enclosed to cover the Provisional filing fees ☒ The Commissioner is hereby authorized to charge any fee deficiency or credit any overpayment to Deposit Account No. 50-0548	PROVISIONAL FILING FEE AMOUNT(S)	$160.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

- ☒ No
- ☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE _____ Date: September 22, 2003

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☐ Additional inventors are being named on separately numbered sheets attached hereto.

PROVISIONAL APPLICATION FILING ONLY

PRESSURE VESSEL FOR INTEGRATED PRESSURIZED FLUID SYSTEM

The present invention relates to an integrated pressurized fluid system, such as for hydraulic regenerative drive system, including a pressure vessel containing a plurality of hydraulic accumulators.

BRIEF DESCRIPTION OF THE DRAWINGS

Objects and advantages of the invention will become apparent from a study of the following specification when viewed in light of the accompanying drawings, wherein:

Fig. 1 is a schematic view of an integrated pressurized fluid system in accordance with the present invention;

Fig. 2 is a cross sectional view of a pressure vessel in accordance with the present invention;

Fig. 3 is a bottom view of the pressure vessel in accordance with the present invention;

Fig. 4 is a perspective view from the front of pressure vessel in accordance with the present invention;

Fig. 5 is a perspective view from the rear of pressure vessel in accordance with the present invention.

DESCRIPTION OF PREFERRED EMBODIMENT

Figs. 1-5 depict an integrated pressurized fluid system, such as for hydraulic regenerative drive system. The integrated pressurized fluid system 1 in accordance with the preferred embodiment of the present invention, depicted in Fig. 1, comprises a pressure vessel 10, a motor/pump 2 in fluid communication with the pressure vessel 10, and an external pressurized reservoir 6, such as hydraulic accumulator or a gas bottle.

The pressure vessel 10, shown in detail in Figs. 2-5, includes a substantially cylindrical housing 12 having opposite flat endplates 14 and 16. The end covers 14 and 16 are firmly secured to the housing 12, such as by welding, so as to be leak tight to a desired pressure rating of the pressure vessel 10. The system shall be designed such that the material thickness and welds are sufficient to contain a working pressure of the system 1 with an appropriate safety factor.

The cylindrical housing 12 of the pressure vessel 10 is further provided with a plurality of smaller diameter cylindrical tubes 18 therewithin. Each of the plurality of the cylindrical tubes 18 is adapted to receive a hydraulic accumulator (or gas bottles) 20 that fits inside the tube 18 with a nominal clearance.

The internal tubes 18 have substantially the same length as the housing 12. All tubes 18 are assembled such that their ends are flush. Both ends of the tubes 18 are closed with a circular flat sheet cover member 22 with a circular raised lip around the circumference.

In use hydraulic accumulators (or gas bottles) 20 are placed inside the internal Tubes 18, centered and spaced inside the tubes 18 with spiral wrappings around the

accumulators 20. The nature of these wrappings shall secure the accumulators 20 inside the internal tubes 18 and also allow for forced air circulation between the internal diameter of the internal tubes 18 and the exterior diameter of the accumulators 20.

Preferably, a number of internal baffles 19 within the housing 12 are employed to increase a rate of thermal conduction from the fluid to the internal tubes, reduce the amount of fluid movement, and strengthen the assembly.

The entire system 1 is scaled such that sufficient working cooling fluid 5 may be contained within the pressure vessel 10 between the internal diameter of the housing 12, the external diameter of the internal tubes 18, and the endplates 14 and 16 to allow the accumulators 20 to be charged with fluid.

The pressure vessel 10 of the system 1 allows for efficient heat transfer for both the exterior of the outside tube of the pressure vessel 10 and the inside of the pressure vessel 10 via forced airflow through the inside tubes 10. For this purpose, the system 1 includes a motor fan 10 allowing an air flow F through the pressure vessel 10.

Heat may also be transferred from the external diameter of the accumulators and/or gas bottles 20. The spiral wrappings between the accumulators and/or gas bottles contribute to both the turbulation of the forced air flow and serve to lengthen the path that the forced air flow must follow and therefore increase the time in which the forced air flow and the internal tubes and accumulators and/or gas bottles are in contact, thus increasing heat transfer. Care shall be used in the selection of the materials and thickness of the pressure vessel elements to optimize both the pressure capacity as well as the heat transfer capacity of the system.

The cylindrical design of the pressure vessel 10 also optimizes pressure capacity as a function of system weight. The flat endplates 14 and 16 with a raised lip around the

circumference strengthen the external connection to the housing 12 as well as the connections to the internal tubes 18.

The design also allows for increased protection of the accumulators (or gas bottles) 20. This protection consists of the housing 12, any internal fluid 5, and the internal tubes 18, as well as the separation distances. The design if intended to increase the protection of the gas charged accumulators 20 from ballistic penetration. In addition to this protection the design also allows for the re-direction of any gas or fluid discharged from a punctured accumulator or gas bottle. The nature of the design directs the flow of any fluid out the ends of the system. Prudent placement/orientation of the complete system would direct any expelled fluid flow in a safe direction.

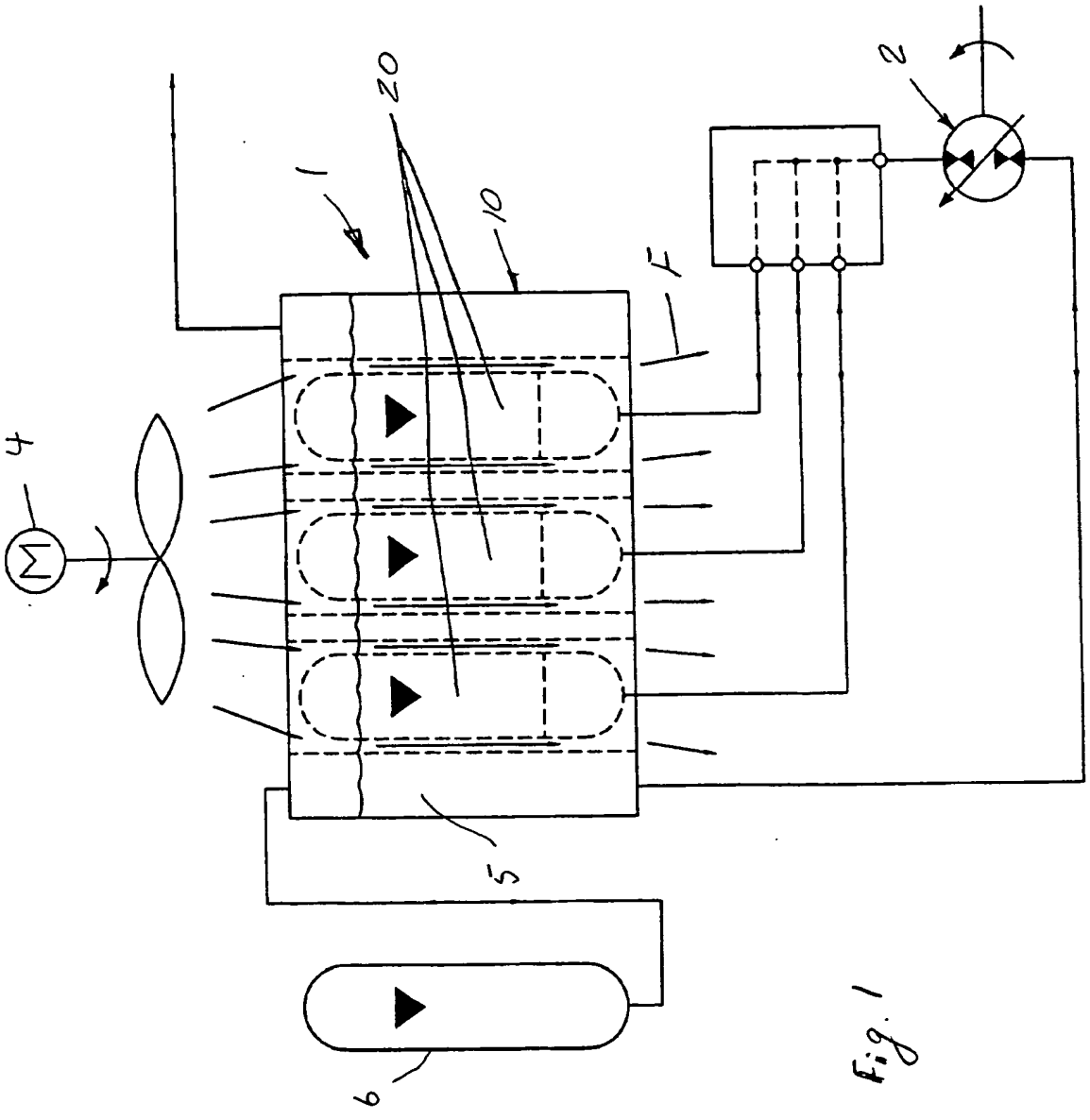

Fig. 1

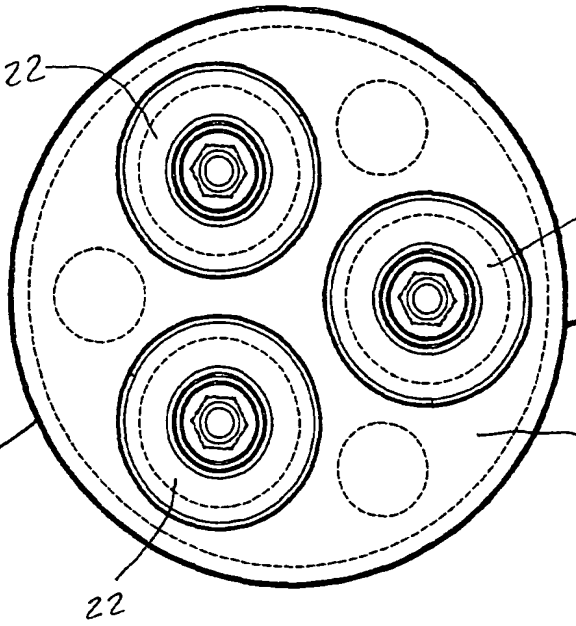

Fig. 3

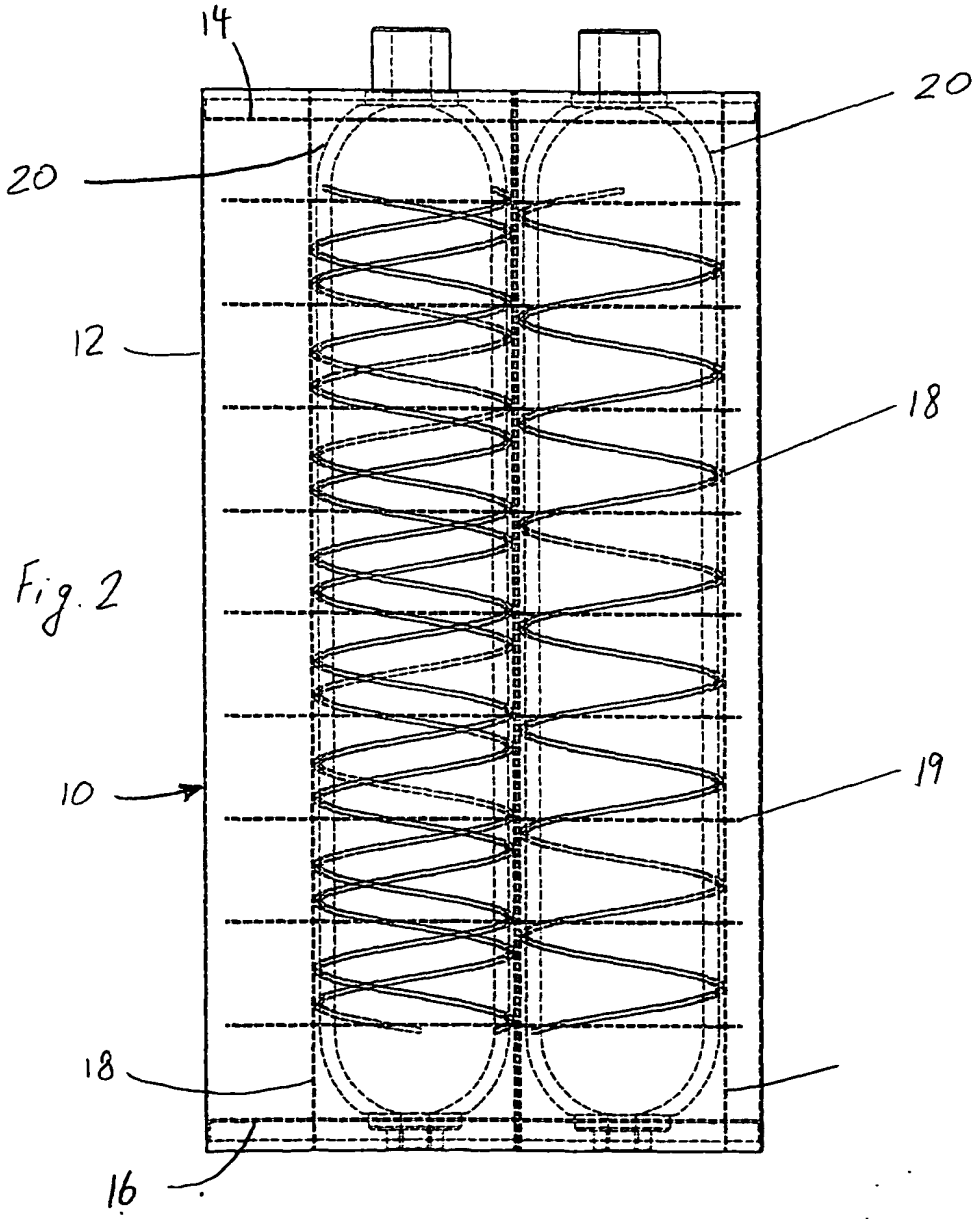

Fig. 2

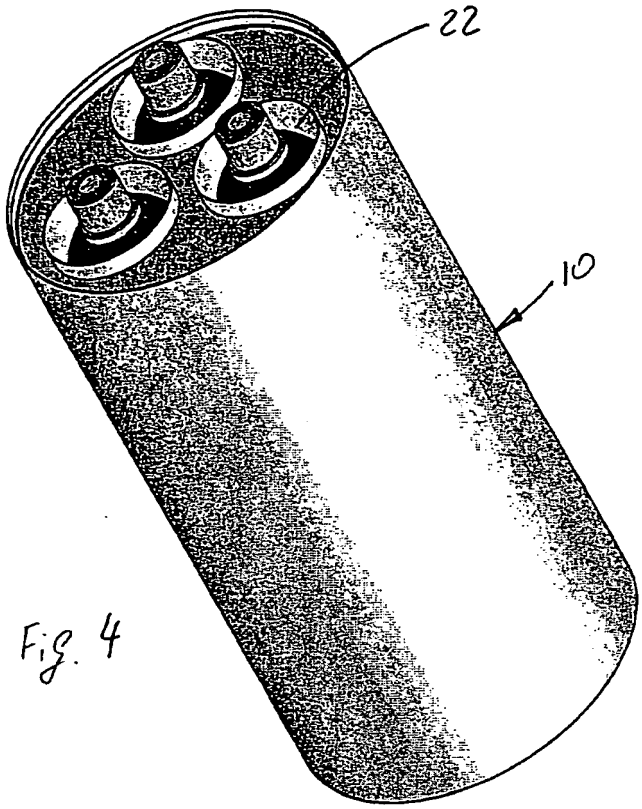

Fig. 4

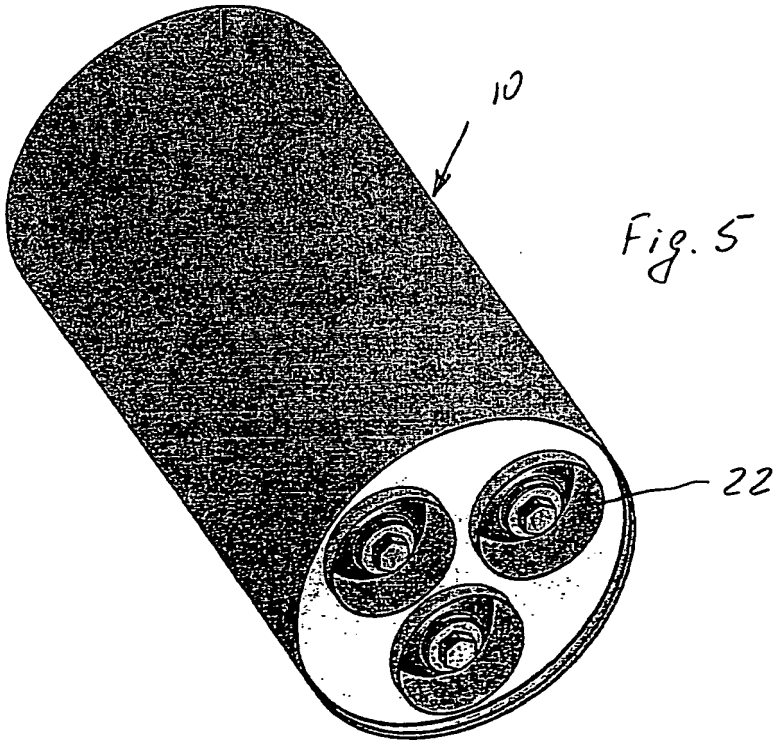

Fig. 5

Document made available under the Patent Cooperation Treaty (PCT)

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